



The moderating role of innovation culture in the relationship between knowledge assets and product innovation

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ARTICLE INFO

Article history:

Received 7 April 2011

Received in revised form 2 July 2012

Accepted 19 August 2012

Available online 26 September 2012

Keywords:

Intellectual capital

Knowledge assets

Moderating effects

Technological innovations

Spain

ABSTRACT

Developing successful technological innovations is essential for creating and sustaining a firm's competitive advantage. This paper analyses the internal complexity that characterises technological innovation in firms. The innovation capability of a firm depends closely on its intellectual and/or organisational knowledge assets and on its ability to deploy these assets. This paper goes beyond the direct relationships between human and technological knowledge assets and product innovation, proposing a moderating role of innovation culture on these relationships. Using a questionnaire to survey 251 Spanish high and medium-high technological manufacturing firms, multiple regression models were developed. After analysing the relationship between human capital and product innovation developed by firms, the results reveal the existence of the moderating role of innovation culture in a knowledge-based product innovation model.

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1. Introduction

The evolution of economic activity in a knowledge economy [1] shows the importance of knowledge or intellectual assets as key production factors in a firm's survival and success. This environment is evolving towards a new competitive arena, whereby firms are engaged in the continuous renewal of their competitive advantages through continuous innovations and the development of new knowledge and capabilities [2–4]. In this sense, one of the best ways for a firm to achieve a competitive advantage comes directly from continuous technological innovation. Following de Brentani, Kleinschmidt and Salomo, a firm's new product development strategy is a primary determinant of the firm's performance [5]. Furthermore, the firm's ability to continuously innovate its products and knowledge assets – as a dynamic capability – is essential for its future success [6,7].

Although numerous efforts have been undertaken to understand the technological innovation phenomenon from an external perspective [8,9], further efforts focused on internal analysis are needed to fully understand this complex business activity. As Nonaka and Takeuchi highlighted, the innovation phenomenon is a knowledge-intensive business process that includes the organisation's members and their relationships and other forms of collective organisational knowledge, context and information as well as their effective implementation, which form the basis of technological innovations [10]. Subramaniam and Youndt remarked that technological innovations are related to a firm's intellectual capital (human, structural, and social) endowments [11]. Empirical studies (e.g., [4,12,13]) have tested this argument. Although the basic linkage between firm knowledge and innovation is convincing on the whole, more remains to be understood about its complex nature [11].

Taking into account the previous arguments from an integrative view of 'A Knowledge-Based View of the Firm' [10,14] and 'An Intellectual Capital-Based View of the Firm' [13], our research attempts to examine (i) how human and technological knowledge

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assets could play a crucial role in the technological innovations in high and medium-high technology manufacturing firms in Spain, and (ii) the moderating role of culture on innovation with regard to the aforementioned relationships.

This paper is structured as follows. [Section 2](#) provides a review of the existing literature to outline the theoretical foundations of this study and explains its conceptual framework. In [Section 3](#), the model of analysis and the hypotheses are discussed. [Section 4](#) presents the methodology used in this research, describing the sample, the variables and their measurement properties. [Section 5](#) shows the results from several linear regression models. Finally, [Section 6](#) discusses the empirical results, proposes some future research directions, and reviews the limitations of this study.

2. Conceptual background

During recent years, a number of scholars in the Management field have focused on the internal characteristics of a firm that affect its technological innovation outputs [15], with the studies concentrating particularly on the Resource-Based View – RBV – [9] and other close theoretical developments such as the Knowledge-Based View – KBV – [4,16] and the Intellectual Capital-Based View – ICBV – [11].

The RBV emphasises that a firm's resources and capabilities are the primary determinants of competitive advantage and technological success. Particularly, intangible resources and capabilities that are based mainly on information and knowledge better fulfil the strategic characteristics – using the VRIO Model proposed by Barney [17] (e.g., valuable, rare, inimitable, and organisation) – to achieve and sustain the firm's competitive advantages [17–19], including organisational capabilities, culture, human capital, technological know-how, and experience. Therefore, the RBV is an appropriate theory in which to frame our investigation, which attempts to analyse the role of intangible resources and capabilities in creating competitive advantage through innovation. According to de Brentani et al. [5], several current studies use the RBV in this manner because innovation is considered an important source of competitive advantage [20]. Moreover, the interaction between resources plays an essential role in achieving sustainable competitive advantage. Nevertheless, the RBV suffers from several weaknesses [21] that impede its empirical testing, including its static view of firm competition and the difficulties inherent in the measurement of intangible resources and capabilities.

Recent developments such as the KBV and the ICBV try to overcome the RBV's weaknesses. Using a dynamic perspective, the KBV [14] narrows the focus of the RBV to intangible resources and capabilities that are based on information and knowledge, that is, how knowledge is created, distributed, accumulated, stored, absorbed, and employed in organisations [22]. Furthermore, according to Conner and Prahalad [23], the KBV is the essence of the RBV because the latter involves a knowledge-based perspective and gives importance to the different results among firms because of their different levels of knowledge. Moreover, if knowledge is understood to be the most important resource within a firm, the KBV is then a consequence of the RBV [14]. Finally, Nonaka [24] states that new knowledge is developed by people, but organisations play a critical role in its articulation and dissemination. Examining the knowledge-innovation link, Nonaka and Takeuchi [10] consider innovation to be the most important organisational business activity that is based on knowledge management.

The ICBV is another recent theoretical development that tries to overcome the difficulties in measuring intangible resources and capabilities [13,25,26]. The ICBV may be viewed as a middle-range theory that is focused on the measurement and management of intellectual capital and allows for empirical testing. The term 'intellectual capital' serves as a synonym for intangible assets and knowledge assets. Particularly, "RBV's lack of specificity has raised questions as to its status as a legitimate theory and makes it difficult to design and test empirically" [13, p. 868]. The term 'intellectual capital' plays an increasingly important role as a strategic resource in business competition [1]. In general terms, and following Subramaniam and Youndt's [11] definition, intellectual capital refers to the sum of all of the knowledge stocks that firms utilise for competitive advantage, which represents the distinctive knowledge stocks that are accumulated and distributed through individuals, relationships among individuals, and the organisation itself.

According to Subramaniam and Youndt [11], the innovation capability of a firm is closely linked to its intellectual capital endowments. Nevertheless, although the intellectual capital-innovation link is so convincing, its precise and complex nature requires future, more in-depth research considering moderating and contextual organisational and industry factors.

2.1. Human and technological knowledge assets

It has been generally recognised that economic wealth is derived from knowledge assets and intellectual capital and their applications, replacing, or perhaps supplementing, land, labour, and capital [1]. The term 'intellectual capital' could serve as a synonym for knowledge assets [27]. Based on Edvinsson and Malone's proposal, intellectual capital is a two-level construct: human capital (knowledge created by and stored in a firm's human resources – its employees) and structural capital (the embodiment, empowerment, and supportive infrastructure of human capital) [28].

Although there is no agreement among scholars about this concept, its components, or its variables [1], the conceptual separation of these IC aspects is related, at a basic level, to how each one accumulates and distributes knowledge and information differently, either through (i) individuals; (ii) organisational structures, technological knowledge assets, and IT systems; or (iii) relationships and networks. In a wider sense, these issues represent different expressions of intangible resources and knowledge within a firm.

Human capital refers to the knowledge possessed by employees and their ability to generate it, which is useful for the firm [11]. Nevertheless, although the human brain is considered the main source of knowledge creation, organisations are able to

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